

A REVIEW ON COVISHIELD VACCINE FOR COVID-19

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ABSTRACT

A Coronavirus (SARS-CoV-2) was emerged in wuhan, china in late December 2019. The ICTV named the virus as SARS-CoV-2 and the disease as COVID-19. The disease can spread through both direct means or by indirect contact. The most common symptoms are fever, chills, dry cough, fatigue, shortness of breath, head and muscle pain, weight loss, etc. The COVID-19 disease can be diagnosed by RT-PCR assay and by the serological evaluation of IgM, IgG antibodies. The ChAdOx1 nCoV-19 vaccine (AZD1222) was developed at Oxford University. The COVISHIELD vaccine was manufactured in the Serum Institute of India. Covishield vaccine was used for the prevention of the COVID-19. Its efficacy rate is 81.3%. The following study elaborates about the ingredients of vaccine, dose, route of administration, mechanism of action and pharmacodynamics of the vaccine. Once the vaccine is injected, it instructs the human cell to produce immunity against the coronavirus. The side effects of the vaccine and tips to reduce the side effects were elaborated in the study.

KEYWORDS: Coronavirus, symptoms, transmission, diagnosis, COVISHIELD, mechanism of action, pharmacodynamics, side effects.

INTRODUCTION

The coronavirus currently named as the 2019 Novel Coronavirus was emerged in Wuhan, China in late December 2019 has spread across the world. COVID 19 was caused by strain of coronavirus known as SARS-CoV-2.^[1] The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease COVID 19. Coronavirus can cause illness such as common cold, Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS). SARS-CoV-2 can spread through both direct means (droplets and human-to-human transmission) and by indirect contact (contaminated objects and airborne contagion). Meanwhile, personal protective equipment (PPE) is also the source of airborne infection. SARS-CoV-2 can be diagnosed via one of the subsequent methods real-time reverse transcriptase-polymerase chain reaction (RT-PCR) assay and serological evaluation of antiviral immunoglobulin M (IgM) and G (IgG) antibodies. Vaccine could play an important role in increasing population immunity, preventing severe disease and reducing ongoing health crisis. The ChAdOx1 nCoV-19 vaccine (AZD1222) was developed at Oxford University. It was a viral vector type of vaccine and has an efficacy rate of 81.3%. The vaccine was given through intramuscular (IM) injection. 2 doses of vaccine should be taken to prevent the COVID-19.^{[5][6]} Efficacy of the vaccine in the prevention of all COVID-19 instances has been estimated as 67%, while efficacy in the prevention of serious COVID-19 (including

hospitalizations and death) is 100%. When the vaccine is injected, it instructs the human cells to produce the SARS-CoV-2 spike protein – the immune system's predominant target in coronaviruses. The common side effects includes, pain or tenderness at the injection site, head ache, tiredness, fever, chills, nausea etc. and rarely allergic reactions and anaphylaxis.^[7]

CORONA VIRUS

A new type of coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV- 2) was emerged from wuhan, China in late December 2019 and resulted in a formidable outbreak in many cities in china and expanded globally including Thailand, Republic of Korea, Japan, United States, Philippines, Viet Nam, and other countries.^{[1],[2],[3]} On 30 January 2020, the World Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern (PHEIC) and on 11 March 2020, a pandemic. It belongs to the Coronaviridae family in the Nidovirales order. Coronavirus are minute in size (65-125 nm) in diameter and contain single-stranded RNA as a nucleic material, size ranging from 26 to 32 kbs in length. The subgroups of coronaviruses family are alpha (α), beta (β), gamma (γ) and delta (δ) coronavirus. The infected patients exhibited pneumonia symptoms with diffused alveolar injury which lead to Acute Respiratory Distress Syndrome (ARDS).^[4]

The causative virus was initially named as “novel coronavirus 2019” (2019-nCoV) by the World Health Organisation (WHO), but it was then renamed as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee of Coronavirus Study Group (CSG), and the disease called “coronavirus disease 2019”(COVID-19) by WHO.^{[8],[9]}

RECOMMENDATIONS TO PREVENT THE SPREAD OF COVID-19

- Frequently clean the hands using alcohol-based hand rub or soap and water.
- Cover the nose and mouth with a flexed elbow or disposable tissue when coughing and sneezing.
- Avoid close contact with anyone that has a fever or cough.
- Wear a mask-whenver outside in a public place.^{[10],[11],[12]}

SYMPTOMS OF COVID-19

COVID-19 influences the respiratory tract in humans. The contamination starts off with slight flu-like symptoms, similarly progress to extreme symptoms. In the majority of cases i.e. 80% will show off moderate symptoms, 14% will have pneumonia, 5% will suffer from septic shock and organ failure (mostly respiratory failure) and in 2% instances it will be fatal.^[13]

The symptoms of COVID-19 include fever, dry cough, tachypnea, fatigue, shortness of breath, chills, muscle

pain, head ache, gastric disturbances, and weight loss. Although diarrhea was present in about 20-25% of patients. Some patients may have lymphopenia and bilateral ground glass opacity changes in the chest CT scans. However, a large population of infected patients have no or mild and remain asymptomatic.^[14]

Other symptoms include, sore throat, sneezing, nasal congestion, sputum production, anosmia and dyspepsia, rash on the skin, or discoloration of fingers and toes and viral conjunctivitis. Some laboratory research has shown the incidence of cytokine storm, sepsis and RNAemia in COVID-19.^[15]

TRANSMISSION OF COVID-19

COVID 19 is contagious viral infection that can spread through inhalation or ingestion of viral droplets as a result of coughing, sneezing and touching the infected surface are the primary sources of infection. The incubation period of virus ranges from 2-14 days. Person-to-person spread of SARS-CoV-2 is supposed to occur mainly via respiratory droplets, when a patient coughs, sneezes, or even talks and sings. However, SARS-CoV-2 remains intact and contagious in droplets and can be suspended in the air upto three hours. The spread of SARS-CoV-2 from asymptomatic individuals (or individuals within the incubation period), without any radiological findings, has also been reported.

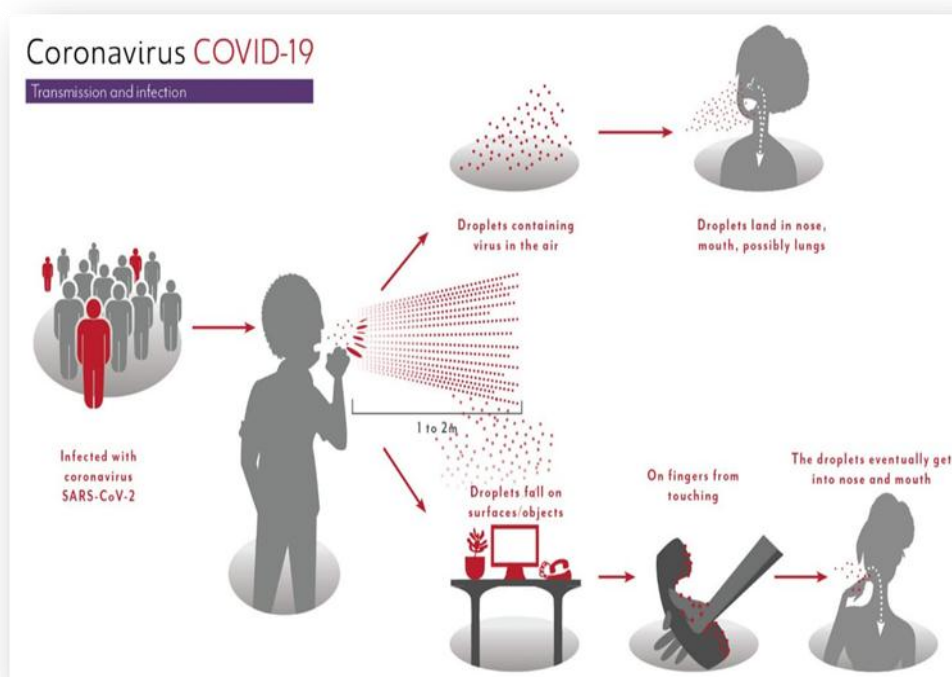


Figure 1: Transmission of Sars-CoV-2.

DIAGNOSIS OF COVID-19

In accordance with China National Commission, COVID-19 can be identified by RT-PCR assay and serological evaluation of antiviral IgM and IgG antibodies. SARS-CoV-2 RNA is identified by RT-PCR. Samples from throat swabs (nasopharyngeal in children), sputum, lower airway secretions, stool and blood could be checked for SARS-CoV-2 ribonucleic acids. Negative RT-PCR results from oropharyngeal swabs, regardless of CT findings indicative of viral pneumonia, have been demonstrated in certain cases that ultimately shown to be positive for SARS-CoV-2. Laboratory testing of SARS-CoV-2 RNA may result false-negative results, and serological analysis of virus-specific IgM and IgG antibodies should be utilized as an option for diagnosis.^[16]

COVISHIELD VACCINE

Vaccine could play an important role in increasing population immunity, preventing severe disease and

reducing ongoing health crisis. Currently 48 vaccines are under the clinical trialevaluation, several of these have shown good safety and immunogenicity, 11 of these are currently being evaluated in phase III clinical efficacy studies.^[17] The ChAdOx1 nCoV-19 vaccine (AZD1222) was developed at Oxford University and consists of a replication-deficient chimpanzee adenoviral vector ChAdOx1, containing the SARS-CoV-2 structural surface glycoprotein antigen (spike protein; nCoV-19) gene.^[18] TheChAdOx1 nCoV-19 corona virus vaccine(Recombinant)-COVISHIELD was manufactured by Serum Institute of India (SII) in Pune. On 03-January-2021, the vaccine was approved by a Subject Expert Committee (SEC) of the Drug Controller General of India (DCGI). The covishield vaccine is approved for the restricted use in emergency situation vaccine that may prevent COVID-19 disease in individuals 18 years of age and older.^{[19][20]}

Table 1: Description and Overview of Covishield Vaccine.

PRODUCT OVERVIEW	
Vaccine type:	COVID-19 Vaccine (ChAdOx1-S[recombinant])
Commercial name:	COVISHIELD™
Manufacturer:	Serum Institute of India Pvt. Ltd
Country:	India
URL:	https://www.seruminstitute.com/
Responsible NRA:	Central Drugs Standard Control Organization
Country:	India
URL:	https://cdsco.gov.in/opencms/opencms/en/Home
WHO RECOMMENDATION	
Effective date:	15 February 2021
PRODUCT DESCRIPTION	
Pharmaceutical form:	Solution for injection
Presentation:	Vial
Number of doses:	2 doses
Diluent:	Not applicable
Route of administration:	Intramuscular
Shelf-life:	9 months at storage temperature:2°C to 8°C
Vaccine vial monitoring :	none
Handling of opened multidose-vials:	WHO recommends that opened vials of this vaccine should be discarded 6 hours after opening or at the end of the immunization session. ^[21]

Who should not get the covishield vaccine?

- If a person had a serious allergic reaction (including anaphylaxis) to:
 - a previous dose of COVISHIELD
 - any ingredient of COVISHIELD
- If you had a major blood clot occurring at the same time as having low level platelets (thrombocytopenia) after receiving any COVID-19 vaccine should not receive a second dose of ChAdOx1 nCoV-19 vaccine(Recombinant).^[22]

INGREDIENTS AND DOSE OF COVISHIELD VACCINE

The ingredients of the covishield vaccine includes, L-Histidine, L-Histidine hydrochloride monohydrate, Magnesium chloride hexahydrate, Polysorbate 80,

Ethanol, Sucrose, Sodium chloride, Disodium edentate dehydrate (EDTA), Water for injection.

The covishield vaccination course consists of two separate doses of 0.5 ml each. The second dose should be administered between four to six weeks after the first dose.^[23,24]

ROUTE OF ADMINISTRATION

The Covishield vaccine will be given through intramuscular (IM) injection only, preferably in deltoid muscle.^[23,24]

HOW DO THE VACCINE WORKS

It is made from a weakened version of a frequent cold virus (known as an adenovirus) that was isolated from

the stool of chimpanzees and modified so that it no longer replicates in cells. It has been modified to incorporate genetic fabric shared via the coronavirus – even though it can't reason the illness. Once injected, the

vaccine instructs the human cells to produce the SARS-CoV-2 spike protein – the immune system's predominant target in coronaviruses.

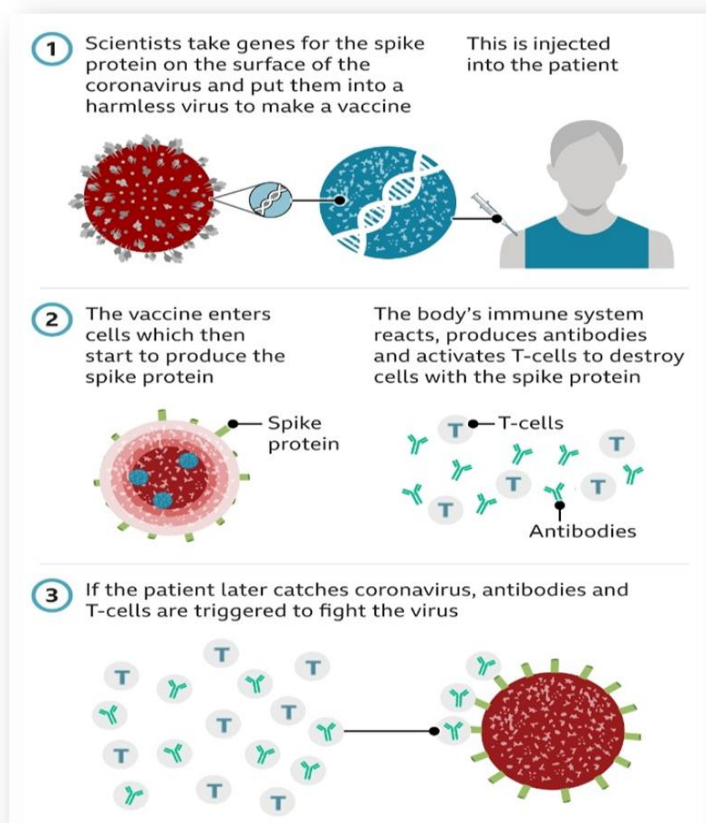


Figure 2: Mechanism of Action of The Covishield Vaccine In The Body.

According to the Centre of Disease Control and Prevention (CDC) America, the vaccine keeps the body out of the grip of corona infection. After applying covishield vaccine, the body kills the corona inside the body through its immunity. The covishield vaccine protects the body from contracting it instead of eliminating the coronavirus. As soon as the vaccine is introduced into the body, it acts a shield to fight against the virus. The covishield vaccine checks the coronavirus and prevents it from entering into the body. If the virus penetrates in tho the body, the vaccine creates antibodies and exists the body.^[25,26]

PHARMACODYNAMICS OF COVISHIELD VACCINE

The AstraZeneca COVID-19 vaccine comprises two intramuscularly-administered doses given 4 to 12 weeks apart. Vaccine efficacy in the prevention of all COVID-19 instances has been estimated as 67%, while efficacy in the prevention of serious COVID-19 (including hospitalizations and death) is 100%. 10 exploratory analyses printed a vaccine efficacy that regarded to expand with increasing dosing interval between the first and second doses 10% to 80% when administered ≥ 12

weeks apart – even though the significance and validity of this statement is presently unclear. In November 2021, Health Canada launched a public advisory concerning a rare danger of immune thrombocytopenia related with the AstraZeneca COVID-19 vaccine (Vaxzevria) – patients are recommended to seek immediately medical cure if they experience any of the following after vaccination: unexplained bleeding, unexplained bruising, small red spots beyond the website online of vaccination, shortness of breath, chest pain, leg ache and /or swelling, and persistent stomach pain.^[27]

MECHANISM OF ACTION

The AstraZeneca COVID-19 vaccine is a replication-deficient (i.e. inactivated) chimpanzee adenovirus vector – mainly the ChAdOx1 vector – encoding a trimeric pre-fusion form of the SARS-CoV-2 spike (S) protein. 5 Following intramuscular administration these spike proteins are expressed locally, allowing the immune device to mount a neutralizing antibody / cellular immune response. This initial publicity and priming of the immune machine because of this presents safety in opposition to future infection.^[27]

BENEFITS OF COVISHIELD VACCINE

In ongoing clinical trials, the covishield vaccine has been shown to prevent COVID-19 disease following 2 doses given between 4 and 12 weeks apart. The duration of protection against COVID-19 disease is currently unknown. The protection against COVID-19 disease starts from approximately 3 weeks after first dose of covishield. Individuals may not be fully protected until 15 days after the second dose is administered.^[28]

SIDE EFFECTS OF COVISHIELD VACCINE

The side effects experienced by the health and security workers in Nepal after the Oxford / Astrazeneca COVID-19 AZD1222 (Covishield) Vaccination.

- After 30 mins- they experience mild transient headaches, light headedness and dizziness.
- After 4 hours- health workers experiences irritability in mood.
- After 6 hours- Myalgia, nausea, tenderness at injection site and feverish feeling.
- After 12 hours- fever with chills developed which required paracetamol to resolve.
- By the second day- fever head ache resolved, Myalgia and tenderness in the injection site persisted.
- On the third day- early morning awakening and head heaviness and tenderness in the injection site persisted.

Paracetamol (NSAID) is given to resolve the individual's common symptoms. It seems that such mild side effects are acceptable during the COVID 19 vaccination as the body will need some time to adopt the vaccination dose and to trigger the immune system to induce protective antibodies.^{[29][30]}

COMMON SIDE EFFECTS

Vaccine allow the body to build immunity by activating T and B lymphocytes, cells that respectively recognize

the targeted virus and produce antibodies to combat it. While the body builds immunity, it is normal for a person to experience minor side effects.^[31]

According to the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO), common side effects of vaccine include:

- Headache (52.6%)
- Fatigue (53.1%)
- Muscle and joint pain (44% or 26.4%)
- Fever (33.6%)
- Chills (31.9%)
- Nausea (21.9%)

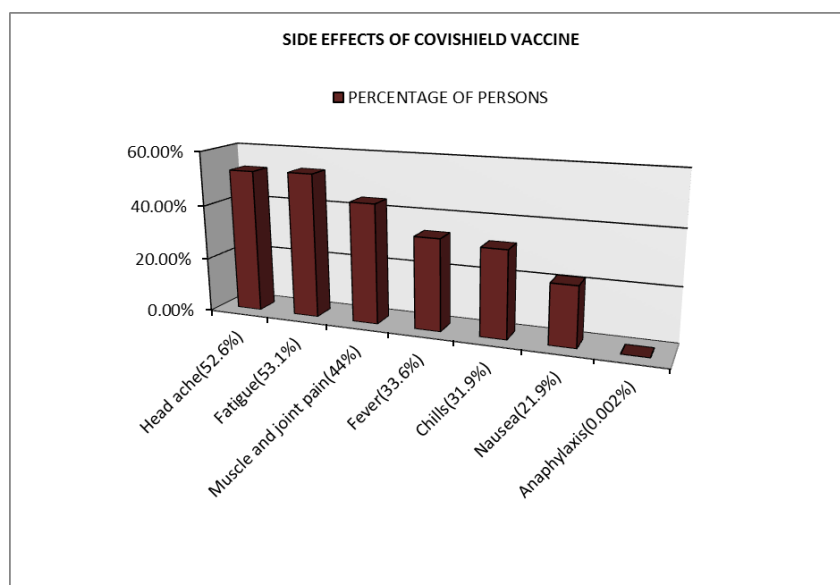
Individuals are also commonly reported pain, irritation, swelling, redness and an itchy rash at the injection site. These are often mild and last for only few days. They are not unexpected.^{[32][33]}

ALLERGIC REACTIONS AND ANAPHYLAXIS

Rarely, a person experiences an allergic reaction to one or more of the ingredients in a vaccine. They might develop hives or another type of skin rash, swelling and respiratory symptoms.

A severe allergic reaction can lead to anaphylaxis, and it involves low blood pressure, nausea and difficulty in breathing, among other symptoms. It is an extremely rare side effect of vaccination. Only (0.002%) were associated with an anaphylaxis-related adverse reaction.

Person who have known allergies to any of the ingredients –the active substance itself or any ingredients listed under the product information “List of excipients”- are advised against receiving the vaccine.^{[33][34]}



Graph 1: Represents The Side Effects of Covishield Vaccine.

Table 2: Side Effects of The Covishield Vaccine.

SIDE EFFECTS OF COVISHIELD VACCINE	
Very Common (may affect more than 1 in 10 people)	<ul style="list-style-type: none"> ▪ Tenderness, pain, warmth, redness, itching, swelling, or bruising where the injection is given ▪ Generally feeling unwell ▪ Feeling tired (fatigue) ▪ Chills or feeling feverish ▪ Headache ▪ Feeling sick (nausea) ▪ Joint pain or muscle ache
Common (may affect upto 1 in 10 people)	<ul style="list-style-type: none"> ▪ A lump at the injection site ▪ Fever ▪ Being sick (vomiting) ▪ Flu-like symptoms such as high temperature, sore throat, runny nose, cough and chills
Uncommon (may affect upto 1 in 100 people)	<ul style="list-style-type: none"> ▪ Feeling dizzy ▪ Decreased appetite ▪ Abdominal pain ▪ Enlarged lymph nodes ▪ Excessive sweating, itchy skin or rash^[35,36]

TIPS TO REDUCE SIDE EFFECTS AFTER GETTING COVISHIELD VACCINE

- To reduce pain and discomfort, use an ice pack or cool, damp cloth to help reduce redness, soreness and/or swelling at the place where the shot was given.
- Use or exercise the arm to reduce the pain where the shot of injection given.
- A cool bath can also be soothing.
- Drink liquids often 1-2 days after getting the vaccine.
- Take an over the counter pain killer unless you have any specific contraindication.
- Dress lightly to reduce discomfort from fever.
- For some symptoms that are severe or last 72 hours or more contact the clinician or primary care provider.^[37]

DISCUSSION

Throughout this review, we have discussed about the COVISHIELD vaccine that was used for the prevention of the COVID-19 disease. The SARS-CoV-2 which was emerged in wuhan, china in late December 2019 and was spread all over the world. The most common symptoms of disease include fever, dry cough, shortness of breath, head and muscle pain, and weight loss. The COVID-19 disease can be diagnosed by RT-PCR assay and by serological examination of IgG and IgM antibodies.

Figure1: Represents the transmission of the SARS-CoV-2 infection. The infection can spread through both direct and indirect contact. Direct contact to the COVID-19 infected person or indirect contact to the objects infected by the droplets of the coronavirus.

The ChAdOx1 n-CoV-19 (AZD1222) vaccine was developed by Oxford University. It was manufacture by Serum Institute of India (SII) in Pune and was approved by the Drug Controller General of India (DCGI)

Table1: Represents the overview-commercial name, vaccine type, manufactured by, country, URL, WHO Recommendation-effective date and the description-diluent, handling, dose, pharmaceutical form, route of administration, storage, self life of the COVISHIELD vaccine.

Figure2: Explains the mechanism of action of the oxford Astrazeneca vaccine. Once the vaccine is injected, it instructs the body to produce the immune cells to kill the coronavirus.

Graph1: Represents the percentage of side effects occur after the post vaccination includes, Headache (52.6%), Fatigue (53.1%), Muscle and joint pain (44% or 26.4%), Fever (33.6%), Chills (31.9%), Nausea (21.9%), anaphylaxis (0.002%)

Table 2: indicates the side effects of post vaccination include, Very Common (may affect more than 1 in 10 people), Common (may affect upto 1 in 10 people), and Uncommon (may affect upto 1 in 100 people).

CONCLUSION

COVISHIELD Vaccine plays an important role in increasing the immunity against the coronavirus. The ChAdOx1 n-CoV-19 vaccine was developed at Oxford University. covishield vaccine was manufactured by Serum Institute of India (SII) and approved on 03-January-2021 by Drug Controller General of India (DCGI). According to the Centers for Disease Control and Prevention (CDC) and World Health Organization(WHO), commonside effects of vaccine include: headache, fatigue, muscle and joint pain, fever, chills, and nausea Individuals area lsocommonlyreportedpain, irritation, swelling, rednessandanitchyrashattheinjection site. They are no tune xpected. It seems that such mildsideeffectsare acceptable during the COVID19 vaccination as the body will need some time to a dopt the vaccination do send to

trigger the immunesystemtoinduceprotectiveantibodies. Allergic reactions and anaphylaxis are extremely rare side effects of vaccination. These side effects can be resolved by taking OTC pain killer, drinking liquids after getting vaccine, and by using ice pack or cool, damp cloth to reduce the redness, soreness and swelling at the injection site. Even though the vaccine has side effects, the efficacy rate of the vaccine is 81.3%. So, everyone should take a 2 doses of COVISHIELD vaccine to prevent the COVID-19 disease.

REFERENCES

- Meng Lv, 1, 2, 3 Xufei Luo, 1, 2, 3 Janne Estill, 4, 5 Yunlan Liu, 1 Mengjuan Ren, 1 Jianjian Wang, 1, 3 Qi Wang, 6 Siya Zhao, 1, 3 Xiaohui Wang, 1 Shu Yang, 7 Xixi Feng, 8 Weiguo Li, 9, 10 Enmei Liu, 9, 10 Xianzhuo Zhang, 11 Ling Wang, 1 Qi Zhou, 11 Wenbo Meng, 12 Xiaolong Qi, 12 Yangqin Xun, 3 Xuan Yu, 3 Yaolong Chen, 3, 13, 14, 15, 16 and on behalf of the COVID-19 evidence and recommendations working group.
- Wu, Yi-Chia; Chen, Ching-Sunga; Chan, Yu-Jiuna, b,c, The outbreak of COVID-19: An overview Journal of the Chinese Medical Association: March, 2020; 83(3): 217-220. doi: 10.1097/JCMA.0000000000000270
- World Health Organization (WHO). Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Geneva: WHO; 30 Jan 2020. Available from: [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov))
- World Health Organization (WHO). WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Geneva: 11 Mar 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>.
- COVID19infection:Emergence,transmission,andcharacteristicsofhumancoronaviruses.MuhammadAdnan Shereenb1RabeeaSiddique
- Nishiga, M., Wang, D.W., Han, Y. et al. COVID-19 and cardiovascular disease: from basic mechanisms to clinical perspectives. Nat Rev Cardiol, 2020; 17: 543–558. <https://doi.org/10.1038/s41569-020-0413-9>
- Melika Lotfi, Michael R. Hamblin, and Nima Rezaei COVID-19: Transmission, prevention, and potential therapeutic cop port unities
- Subramanian Boopathi, Adolfo B. Poma, and Ponmalai Kolandaivel Novel 2019 coronavirus structure, mechanism of action, antiviral drug promises and rule out against its treatment
- Virus Res. 2020 Oct 15; 288: 198114. Published online 2020 Aug 13. doi: 10.1016/j.virusres.2020.198114PMCID: PMC7423510PMID: 32800805. Simran Preet Kaur and Vandana Gupta*
- <https://www.narayanahealth.org:> Coronavirus Complications: How does COVID 19 affect your BODY?
- <https://www.narayanahealth.org:>How to Avoid Coronavirus Infection Transmission?
- <https://www.who.int>coronaviruse:coronavirus> disease (COVID-19) outbreak
- Hui DS, I Azhar E, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health—The latest 2019 novel coronavirus outbreak in Wuhan, China. International Journal of Infectious Diseases, 2020; 91: 264-6. [PMC free article] [PubMed] [Ref list]
- Cascella M., Rajnik M., Cuomo A., Dulebohn S.C., Di Napoli R. Features, evaluation and treatment coronavirus (COVID-19). Statpearls [internet] StatPearls Publishing. 2020 [Google Scholar] [Ref list]
- WHO) WHO. Q&A on coronaviruses (COVID-19) 2020 17 April [Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses#:~:text=symptoms>. [Ref list]
- <https://www.journaldata.com> coronavirus disease 19 (COVID 19): Diagnosis and management. Oner Ozdemir.
- WHODRAFT landscape of COVID-19 candidate vaccines—20 March 2020. <https://www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus-landscape-ncov.pdf?ua=1>Google Scholar
- Merryn Voysey, DPhil *Sue Ann Costa Clemens, PhD *, Shabir A Madhi, PhD *, Lily Y Weckx, PhD *, Pedro M Folegatti, MD *, Parvinder K Aley, PhD, et al. 2020 DOI:[https://doi.org/10.1016/S0140-6736\(20\)32661-1](https://doi.org/10.1016/S0140-6736(20)32661-1)Safety and efficacy of theChAdOx1nCoV-19vaccine(AZD1222)againstSARS-CoV-2: aninterimanaly sis offourrandomisedcontrolledtrialsinBrazil,SouthAfrica,andtheUK
- Kaur SP, Gupta V. COVID-19 Vaccine: A comprehensive status report. Virus Res., Oct 15, 2020; 288: 198114. doi: 10.1016/j.virusres.2020.198114. Epub 2020 Aug 13. PMID: 32800805; PMCID: PMC7423510.
- COVID-19 vaccine Covishield gets approval from DCGI's expert panel, <https://www.thehindu.com>national>
- <https://extranet.who.net,> COVID-19Vaccine(ChAdOx1-S (recombinant))-COVISHIELD
- Who Can and Can't Safely Get the COVID-19 Vaccine. Written by Elizabeth Pratt on January 3, 2021 — Fact checked by Maria Gifford

23. Covid-19: An FAQ factsheet for Covishield vaccine by Serum Institute. <https://health.economictimes.indiatimes.com/news/industry/covid-19-an-faq-factsheet-for-covishield-vaccine-by-serum-institute/80243379>
24. Covid-19: An FAQ factsheet for Covishield vaccine by Serum Institute. <https://www.livemint.com>health>
25. Covid: How does the Oxford-AstraZeneca vaccine work? <https://www.bbc.com/news/health-55302595.amp>
26. How Corona Vaccine Works – Vaccine Mechanism of Action. <https://www.mpnrc.org/how-corona-vaccine-works-mechanism/>
27. AstraZeneca COVID-19 vaccine-Drugbank. <https://go.drugbank.com/drugs/DB15656>
28. COVID-19 vaccine AZD1222 showed robust immune responses in all participants in Phase I/II trial. <https://www.astrazeneca.com/media-centre/press-releases/2020/covid-19-vaccine-azd1222-showed-robust-immune-responses-in-all-participants-in-phase-i-ii-trial.html>
29. Ranjit Sah, Sunil Shrestha, [...], and Alfonso J. Rodriguez-Morales doi: 10.1016/j.tmaid.2021.101989 PMID: 33578045. AZD1222 (Covishield) vaccination for COVID-19: Experiences, challenges, and solutions in Nepal
30. The Kathmandu Post. 2021. Nepal begins first phase of Covid-19 vaccination drive. [Google Scholar] [Ref list]
31. https://www.mohfw.gov.in/covid_vaccination/vaccination/common-side-effects-aefi.html
32. Covishield Vaccine Side-Effects: 4 New Side-Effects Discovered With The Astrazeneca COVID Shot https://m.timesofindia.com/life-style/health-fitness/health-news/covishield-vaccine-side-effects-4-new-side-effects-discovered-with-the-astrazeneca-covid-shot/amp_etphotostory/86068595.cms
33. Global COVID-19 vaccine summary: Side effects. Written by Minseo Jeong on September 6, 2021 <https://www.medicalnewstoday.com/articles/global-covid-19-vaccine-summary-side-effects>
34. Oxford-AstraZeneca vaccine: What to know about side effects, Written by Minseo Jeong on July 15, 2021 <https://www.medicalnewstoday.com/articles/oxford-astrazeneca-vaccine-what-to-know-about-side-effects>
35. https://www.seruminstitute.com/health_faq_covishield.php COVISHIELD FAQs-Serum Institute of India
36. Fact sheet for vaccine recipient approved for restricted use in emergency situation India 'cdsco.gov.in
37. Tips to reduce side effects after getting the COVID-19 vaccine <https://www.ynhhs.org/patient-care/covid-19/vaccine/tips-to-reduce-side-effects.aspx>